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2-4 LANE TRANSITION STUDY

TRAFFIC ENGINEER'S OFFICE
MONT. HIGHWAY COMMISSION
IN CO-OPERATION WITH THE
U.S. DEPT. OF COMMERCE
BUREAU OF PUBLIC ROADS

NOVEMBER 1964

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A STUDY OF

2-4 LANE

TRANSITIONS

REPORT BY
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TRAFFIC ENGINEER'S OFFICE
MONTANA HIGHWAY COMMISSION
IN CO-OPERATION WITH THE
U.S. DEPARTMENT OF COMMERCE
BUREAU-OF PUBLIC ROADS
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SUMMARY

The Montana State Highway Commission, in co-operation with the United States Department of Commerce, Bureau of Public Roads, conducted a study of 2-4 lane transitions during the summer months of 1964. Whenever a 2-lane highway transitions into a 4-lane highway there is a potential hazard to the movement of traffic. A study was set up to determine if our present 2-4 lane transitions constitute a traffic hazard. Twenty transitions on the Interstate System, located generally in the western part of the State, and one transition on the Primary System were studied.

The results of the study indicate that:

1. The over-all wrong-way usage of the 2-4 lane transitions in the study is 0.09%.
2. A total of eight accidents have been reported on all of Montana's Interstate transitions and none can be directly correlated with the type of transition design or the type or number of traffic control devices present.

From these results it is apparent that there is no major traffic problem on 2-4 lane transitions in the summer; however, there are indications that wrong-way movements occur during the winter months when the traffic control devices are snow covered. Since this problem exists only during a short period of the winter at a few transitions it appears that further study would not be justified.

INTRODUCTION

In Montana there are approximately forty 2-4 lane transitions on the Primary and Interstate Systems.

These transitions vary in geometric design and differ in arrangements of striping and signing. Transition designs fall into three general categories:

(1) That on which the 2-lane traffic enters the 4-lane with no appreciable change in direction of travel - Type I.

(2) That on which the 2-lane traffic is forced to make an appreciable change in direction of travel in order to enter the 4-lane section - Type II.

(3) That on which neither the 2-lane nor the 4-lane traffic is forced to make an appreciable change in direction of travel - Type III.

It is apparent that accidents occurring on 2-4 lane transitions are caused by cars going the wrong way on the 4-lane section or by drivers who were confused as to which lane of the 4-lane to take. This wrong-way movement or confusion could be related to the type of transition or types or number of traffic control devices present.

A study was set up during the summer of 1964, to correlate the numbers of accidents occurring at each transition with the type or number of traffic control devices present, the amount of wrong-way traffic and the geometric design of the transition. For the purposes of this study, the three transition designs are referred to as Types of Transitions. The types are described in the first paragraph of

the introduction as Type I, Type II and Type III.

The objectives of the study were:

(1) To determine the relationship between the type of transition and the number of accidents.

(2) To determine the relationship between the type of transition and the amount of wrong-way traffic.

(3) To determine the relationship between the number of accidents on each type of transition and the type or number of traffic control devices present.

The study was set up under the supervision of the Traffic Engineer in co-operation with the Department of Commerce, Bureau of Public Roads. The project was financed with Highway Planning Research funds as part of Project HPR-1(2).

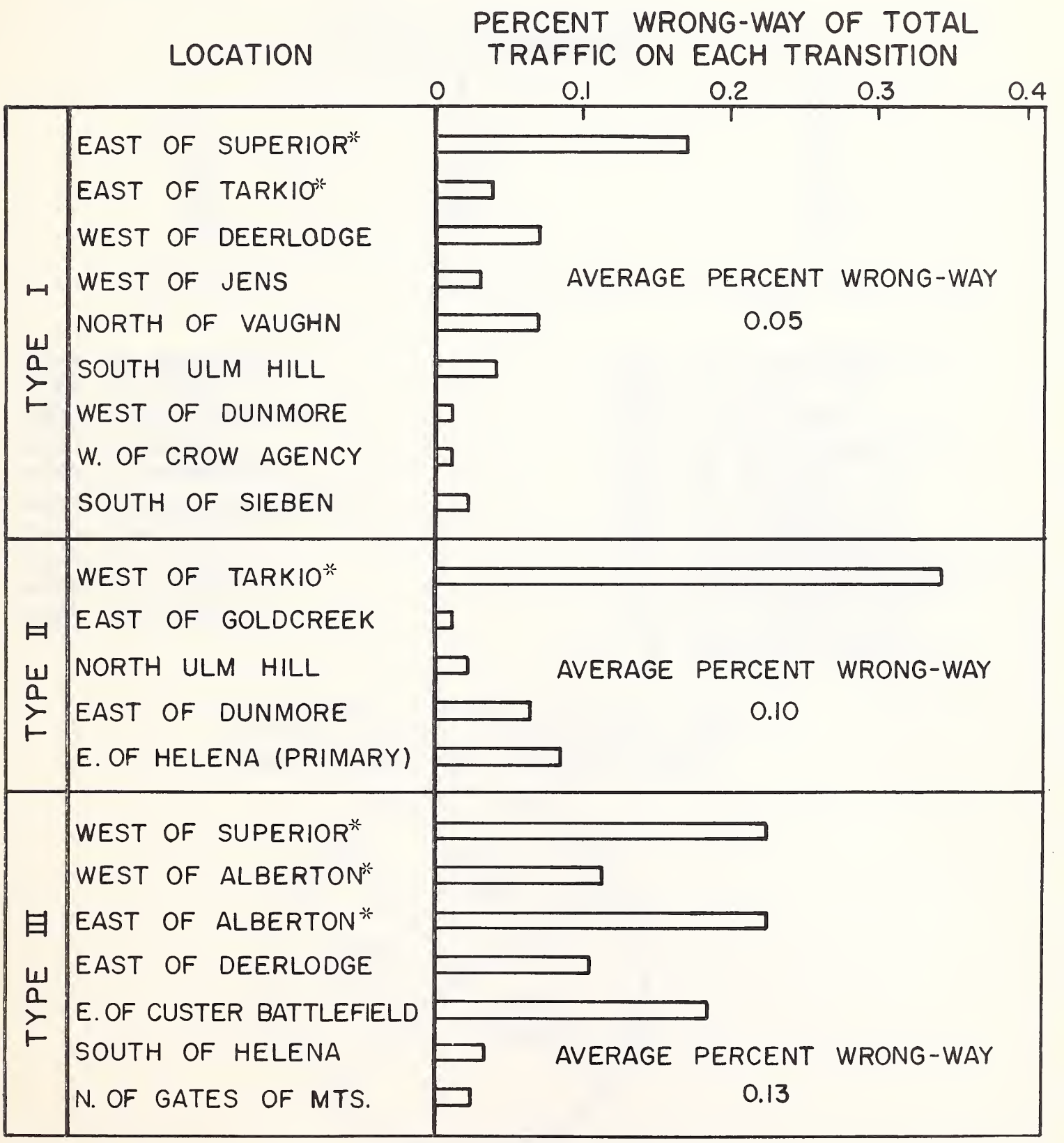
DESCRIPTION

Of the forty 2-4 lane transitions located throughout Montana, twenty-one were selected for the study. Twenty were transitions on the Interstate System and one was on the Primary System. These transitions were selected for the study because they showed distinct differences in striping and transition design. Figure 1 shows the location and the amount of wrong-way movement at each of the transitions. Figure 2 compares the type of transition at each location to the amount of wrong-way movement.

One man was hired to record wrong-way data, research accident files and write a final report on the results of the study. Two K-Hill directional counters were installed at each transition to record wrong-way traffic.

FIG. 1

PERCENT WRONG-WAY ON 2-4 LANE TRANSITIONS

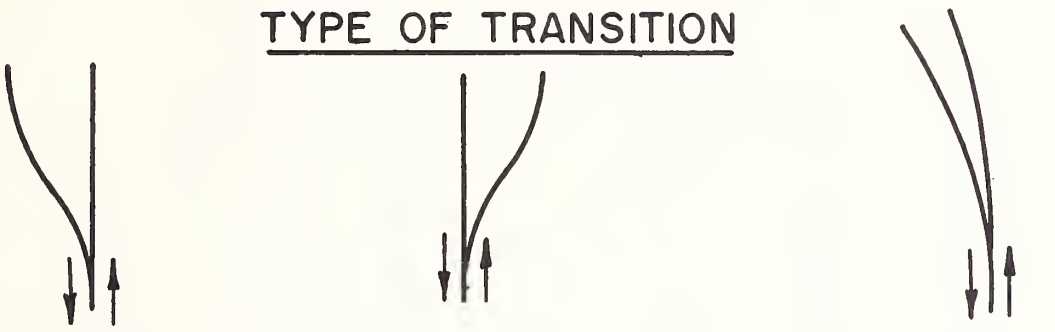


*Counter tube difficulties at these locations accounted for higher wrong-way counts than actually existed. See Page 10, paragraph 2 for explanation.

FIG. 2

COMPARISON OF TYPE OF TRANSITION AND PERCENT WRONG-WAY

TYPE OF TRANSITION



TYPE I - T_1 TYPE II - T_2 TYPE III - T_3

EAST OF SUPERIOR - T_1
EAST OF TARKIO - T_1
WEST OF DEERLODGE - T_1
WEST OF JENS - T_1
WEST OF DUNMORE - T_1
WEST OF CROW AGENCY - T_1
SOUTH ULM HILL - T_1
SOUTH OF SIEBEN - T_1
NORTH OF VAUGHN - T_1
WEST OF TARKIO - T_2

EAST OF GOLDCREEK - T_2
NORTH ULM HILL - T_2
EAST OF DUNMORE - T_2
E. OF HELENA (PRIMARY) - T_2
WEST OF SUPERIOR - T_3
WEST OF ALBERTON - T_3
EAST OF ALBERTON - T_3
EAST OF DEERLODGE - T_3
E. OF CUSTER BATTLEFIELD - T_3
SOUTH OF HELENA - T_3
N. OF GATES OF MTS. - T_3

PERCENT OF TOTAL WRONG-WAY TRAFFIC ON ALL TRANSITIONS

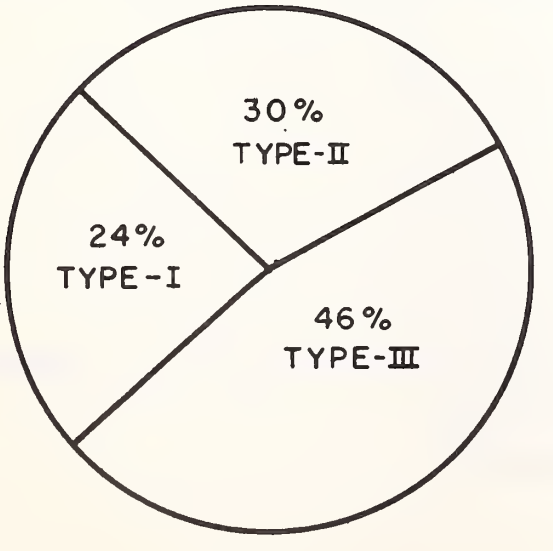


FIG. 3

TYPICAL COUNTER INSTALLATION ON 2-4 LANE TRANSITIONS

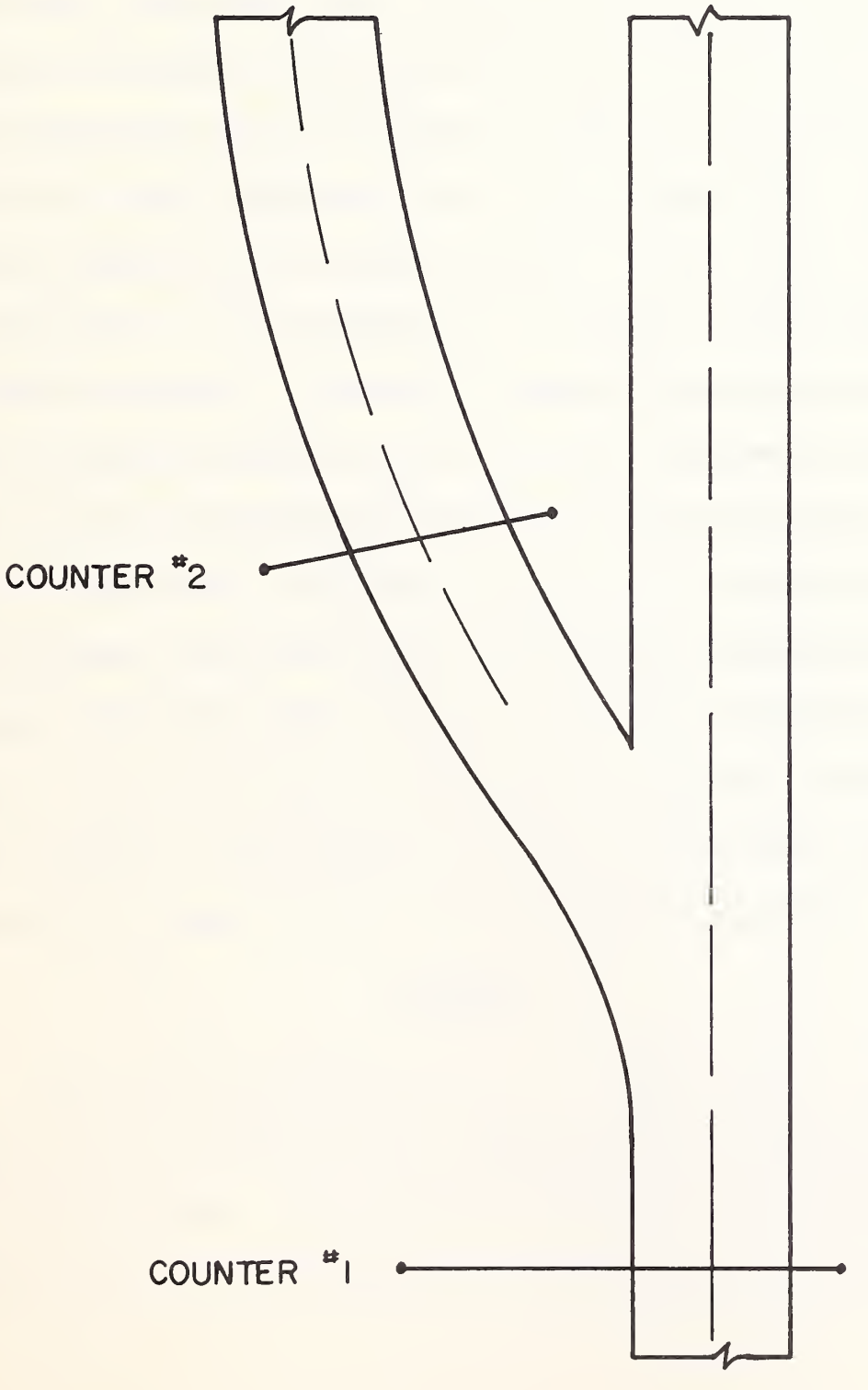


Figure 3 shows the installation of the two counters. For a detailed description of the operation of the directional counter, refer to "Wrong-Way Ramp Usage Study", prepared by the Traffic Engineer's Office, Montana State Highway Commission, March 1964, page 14. The counters were in operation for a period of at least six days at each transition, during which time traffic characteristics were noted and pictures of signing and striping were taken. Highway Patrol and Maintenance personnel were interviewed in order to gain a better over-all picture of traffic operations under varying conditions. Seasonal weather conditions and increased volumes of traffic were of particular importance to the investigator in gaining a better understanding of traffic movements. According to Highway Patrolmen, there is very little wrong-way movement during the summer. However, wrong-way movement increases considerably during the winter months when visibility is poor and snow covers the highway. According to Patrolmen and Maintenance personnel, two transitions that experience considerable wrong-way movement during the winter months are Gates-of-the-Mountains and West Tarkio. During the winter of 1963-1964, Maintenance personnel had to direct traffic on two different occasions at the Gates-of-the-Mountains transition in order to keep cars from going the wrong-way.

ANALYSIS

During the study period, (July 3 - August 26),the counters registered a total of 158,077 correct vehicles and 139 wrong-way vehicles, or 0.09% wrong-way. Also, during this period, the investigator saw a total of four cars traveling in the wrong direction on the 4-lane

section. Two had entered at the transition west of Tarkio, one entered west of Superior, and one entered at the transition north of Ulm hill. Figure 1 indicates that West Tarkio, which is of Type II design, has the highest per cent wrong-way (0.34%). Figure 2 shows the type of design at each transition location.

Included in the study were nine Type I transitions, five Type II transitions and seven Type III transitions. The pie-shaped graph compares the total wrong-way movement (on a percentage basis) of the three types of transition. The values in Figure 1 show that during the days that each transition was studied there was very little wrong-way movement. The per cent of wrong-way movement was noticeably higher at Tarkio, Superior and Alberton transitions than at the other transitions in the study. The higher wrong-way movement was attributed to the counter tubing turning over and recording wrong-way movement when there was none. This problem was considerably reduced at the other transition by taping several 3/16" X 3" X 4' fiberglass pads to the tube to hold it in position. Due to the lack of time the wrong-way traffic at Tarkio, Superior and Alberton transitions was not re-checked.

A study of the accident files revealed that, since the date construction was completed, a total of eight accidents occurred at transitions on the entire Interstate System. Due to the limited amount of time, the transition east of Helena was the only transition on the Primary System that was included in the study. One accident occurred on this transition.

Of the eight accidents on the Interstate System, five occurred on Type III design, three on Type II and none on Type I design. Due to

the small number of accidents occurring at any one transition and the incomplete description of what happened in the accident report, it was difficult to determine if a type of transition or a traffic control device contributed to the cause of an accident.

The study also showed that there is a need for more uniformity in signing and striping. Typical examples of the inconsistent use of traffic control devices are shown in Figures 4 and 5. According to the "Manual on Uniform Traffic Control Devices", "Keep Right" signs should only be used at the ends of medians where traffic should keep right of such obstructions. Figure 6 is a "Keep Right" sign 24" X 24". Generally on the Interstate System, "Keep Right" signs located in the gore area are 48" X 60", as set forth in the "Manual for Signing and Pavement Marking of Interstate and Defense Highways." Figures 7-13 show the different types of striping at each transition. In almost all cases the striping does not conform to standard practice. Figure 14 is the standard drawing showing how the striping should be laid out. The standard was recently revised to show paint stripes in place of the jiggle bars formerly used.

DISCUSSION OF RESULTS

An analysis of the data gathered on the 2-4 lane transitions indicates that:

(1) All accidents occurring at 2-4 lane transitions were on either Type II or Type III design but, due to the limited number of accidents, no sound conclusion can be reached.

(2) There is a higher per cent of wrong-way movement on Type II and Type III transitions than on Type I; however, a statistical analysis indicates that the differences are not significant.

Fig. 4 - Incorrect Use of "KEEP RIGHT" Sign
Just Before North Ulm Hill Transition

Fig. 5 - Incorrect Use of "KEEP RIGHT" Sign
West of Jens

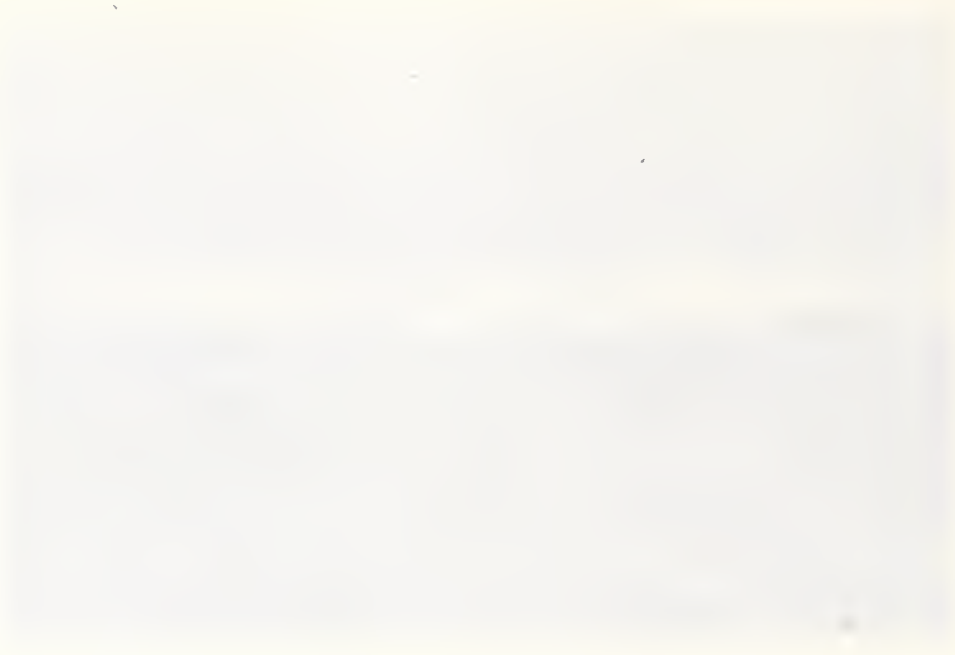


Fig. 6 - Non-Uniform "KEEP RIGHT" Sign
West of Springdale

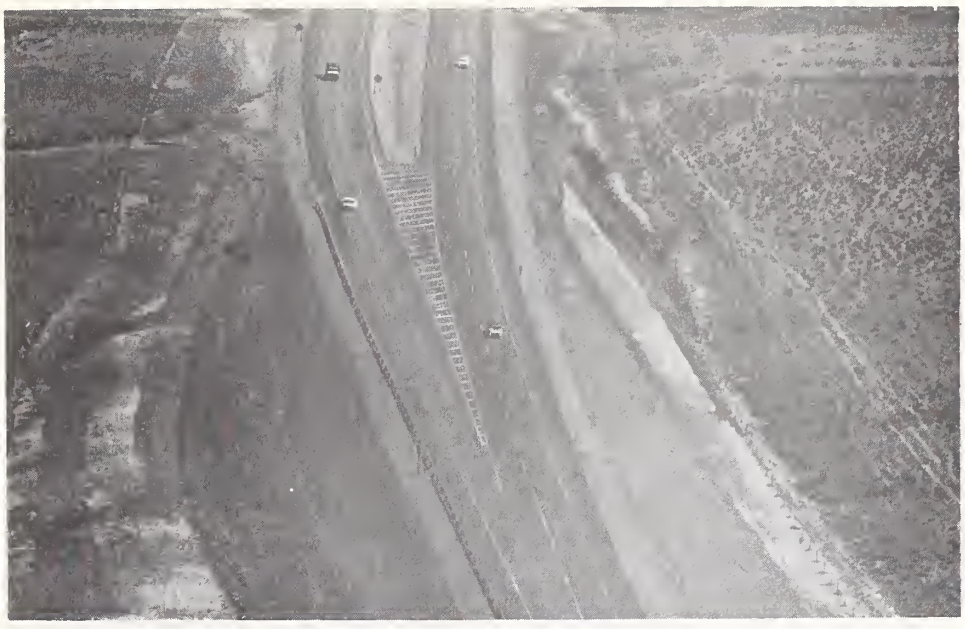


Fig. 7 - Transition North of Gates of the Mountains
Correctly Striped

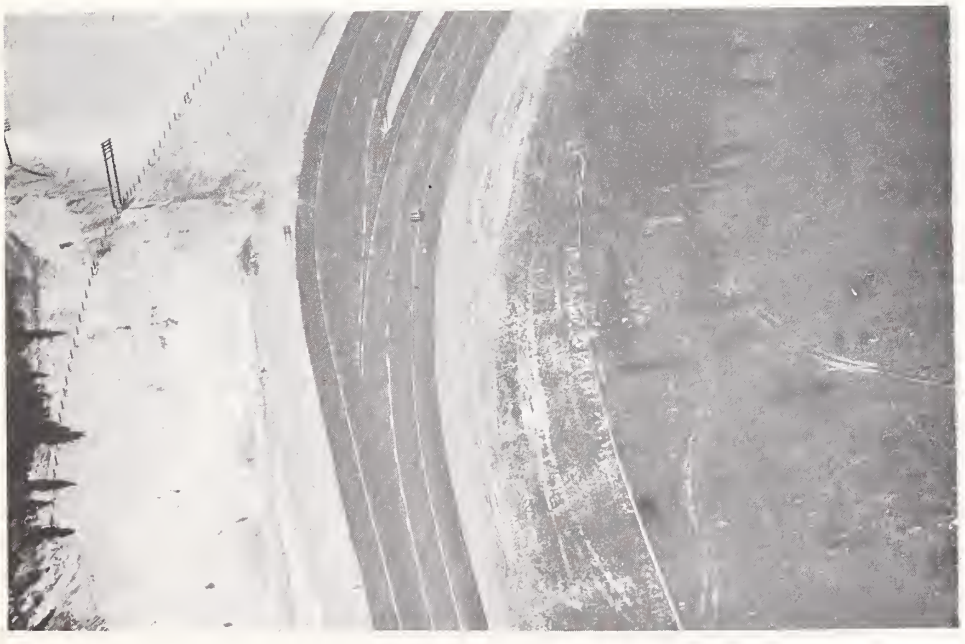


Fig. 8 - Transition East of Alberton
(No Paint Stripes, Incorrect Gore Striping)

Fig. 9 - Transition West of Springdale
(No Paint Stripes, Gore Striping too Narrow)

Fig. 10 - Transition East of Superior
(Striping Obliterated)

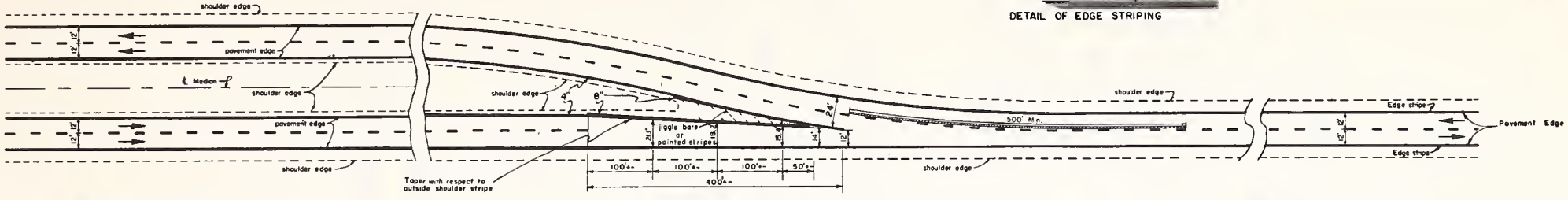
Fig. 11 - Transition East of Dunmore
(No Paint Stripes, Incorrect Gore Striping)

Fig. 12 - Transition East of Tarkio
(Centerlines Should Not Intersect)

Fig. 13 - Transition West of Dunmore
(Gore Striping Wrong and No Passing Stripes Wrong)

FED. ROAD DIV NO	STATE	FED. AID PROJ. NO		SHEET NO	TOTAL SHEETS
8	MONT.				

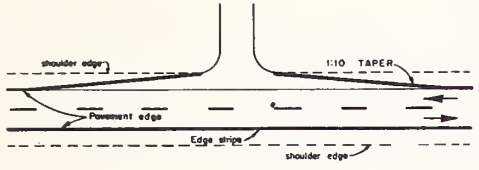
DETAIL OF EDGE STRIPING



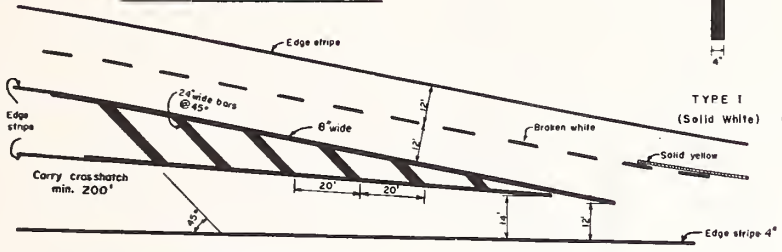
TYPICAL 4-LANE MARKING

TYPICAL TRANSITION MARKING — 2-LANE to 4-LANES DIVIDED

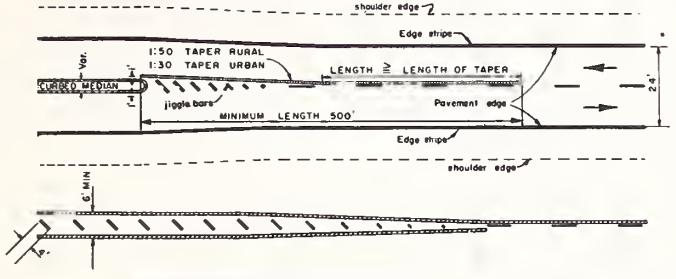
TYPICAL 2-LANE MARKING



TYPICAL APPROACH - 2 LANE

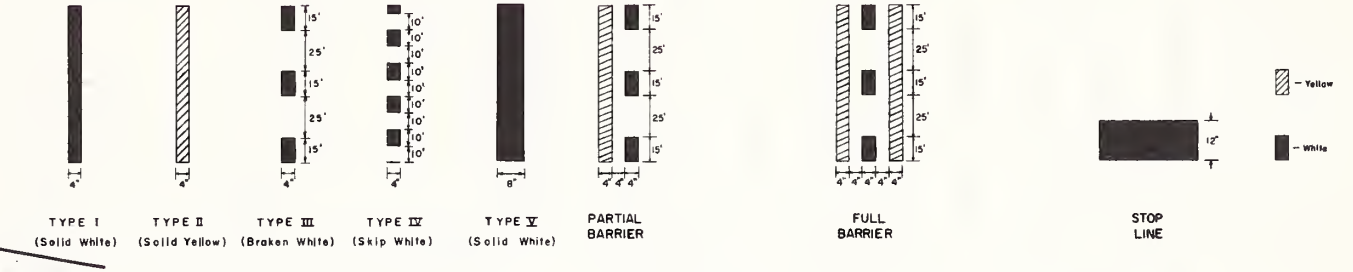


TYPICAL PAINTED BARS AT TRANSITION OR SEPARATOR

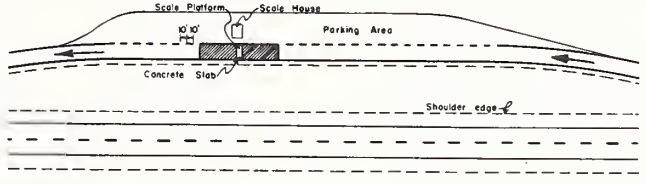


TYPICAL TRAFFIC SEPARATOR MARKING FOR TWO LANE HIGHWAY

Note:
For jiggle bar traffic separators, carry inside edge-stripe through entire separator length



DETAIL OF STRIPES



Note
Accel. lane & decel. lane markings shall be the same as shown on Standard Details No.14-Typical Accel & Decel Lane Marking

TYPICAL TRUCK WEIGH STATION MARKING

FIG. 14

STATE OF MONTANA
STATE HIGHWAY COMMISSION
TRAFFIC ENGINEER
STANDARD DETAILS NO. 14-A
PAVEMENT MARKINGS
NO SCALE

DESIGNED	D.H.H.	3/23/59
DRAWN	J.A.L.	3/25/59
TRACED	D.H.H.	4/1/59
CHECKED	J.W.H.	4/8/59
REVISED	D.W.C.	5-18-60
REVISED	C.R.D.	8/25/60

REV. D.R. 9-9-60

STATE PRECONST NUMBER

DRAWING NO. TE-PM 14A

(3) No definite relationship can be drawn to correlate the type or number of traffic control devices with the number of accidents occurring at each transition.

(4) There is an indication that more wrong-way usage occurs during winter months than during the summer.

The results of this study show that there is very little wrong-way movement during the summer; however, there is an indication of more wrong-way movement during the winter months when the traffic control devices are snow covered. Since this problem exists only during a short period of the winter at a few transitions it was decided that it would not be justified to continue this study. We plan to solve this problem by individual traffic studies at each transition concerned.

RECOMMENDATIONS

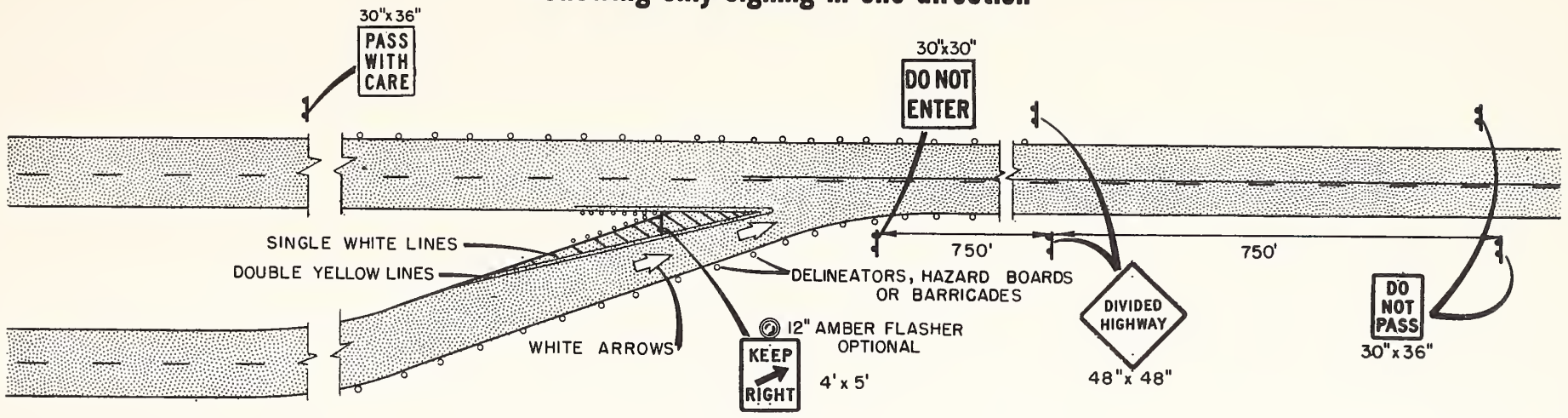
From the results obtained from the summer study it is felt that no definite conclusions can be drawn. If a study is conducted in the future when a definite problem developes, better results could be obtained by studying one selected transition for a number of months instead of days. The study could be conducted on a "before" and "after" basis. The installation of permanent directional counters for a period of months would give an idea of the amount of wrong-way movement. This would serve as part of the "before" study. If there was considerable wrong-way movement, changes in signing or striping could be made and the "after" portion of the study would determine if the changes affected the directional movement of traffic.

Listed below are some of the possible changes;

1. The use of reflectorized barricades in the taper lane.
2. Arrows painted on the highway to show direction of travel.
3. The use of a warning light on the "Keep Right" sign in the gore.

Figure 15, which is from a ciruclar memorandum published by the U. S. Department of Commerce, Bureau of Public Roads, August 21, 1964, shows different types of signing and striping. The testing of different types of signs on transitions could be of great value in preventing wrong-way movement.

EXHIBIT E-TYPICAL REGULATORY AND WARNING SIGNS AT 2 TO 4 LANE TRANSITIONS
Showing only signing in one direction



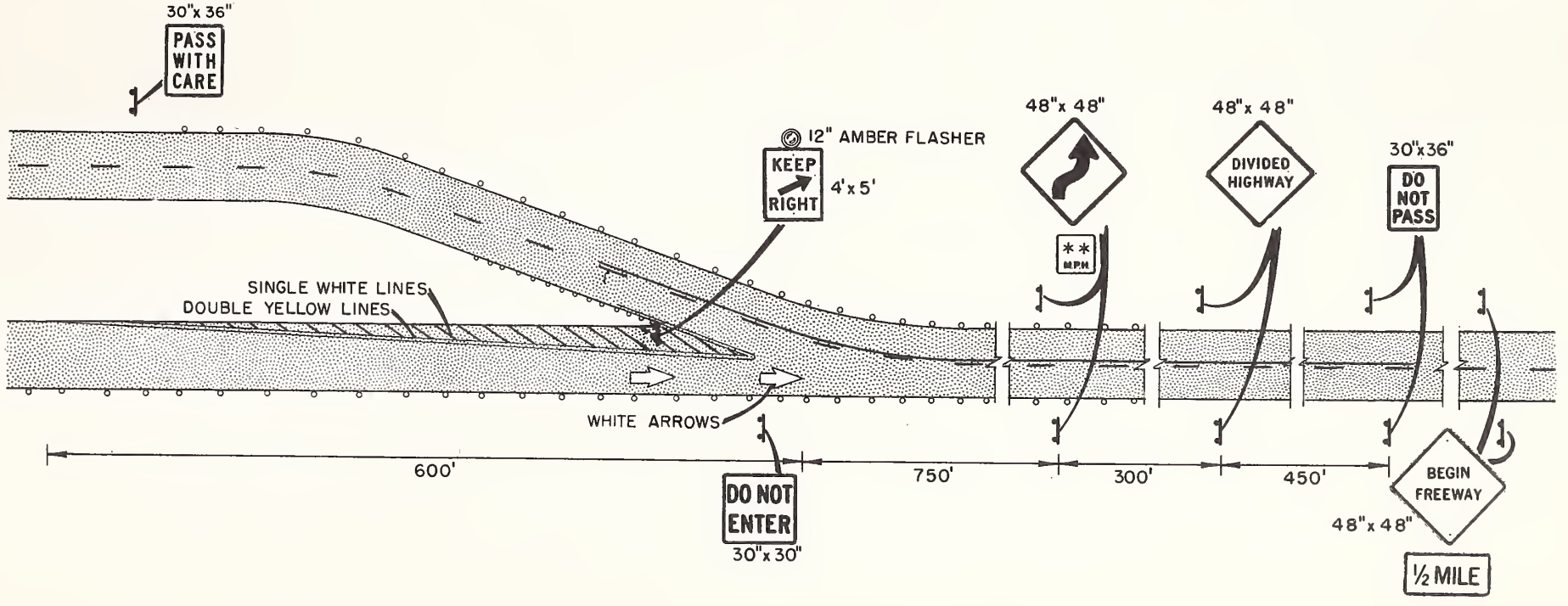


FIG. 15